Lead chloride-filled single-walled carbon nanotubes

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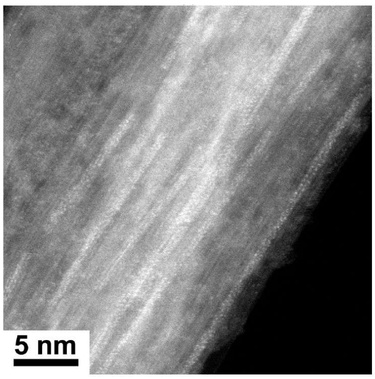
INTRODUCTION & AIM

Single-walled carbon nanotubes (SWCNTs) are prepared via three methods, arc-discharge, laser ablation, and chemical vapour deposition. The arc-discharge and laser ablation methods result in the powders of the bundled SWCNTs, which are further organized into films. The chemical vapour deposition method leads to ordered SWCNTs, which are further processed to form films. In this work, we formed the films from the arc-discharge SWCNTs, and they had high purity and quality. We performed the filling of the SWCNT films with lead chloride using the melt method [1-4]. It resulted in high filling ratios of the SWCNTs.

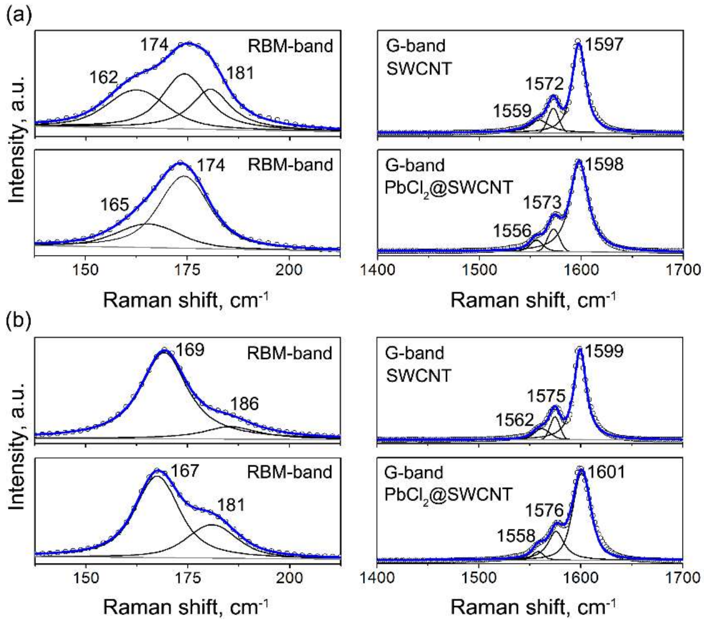
METHOD

Lead chloride and SWCNTs were sealed under high vacuum in quartz ampoules, and they were heated in the tube furnace up to the preparation temperature, 601°C. They were left at this temperature for 6 hours, and then cooled down to room temperature. The obtained samples were characterized with transmission electron microscopy (TEM), Raman spectroscopy, and X-ray photoelectron spectroscopy (XPS).

RESULTS & DISCUSSION



The scanning transmission electron microscopy image of the lead chloride-filled SWCNTs [2].



The Raman spectra of the pristine, and lead chloride-filled SWCNTs acquired at the laser wavelengths of 458 (a), 488 nm (b).

CONCLUSION

TEM confirmed the filling of the SWCNTs. Raman spectroscopy and XPS showed the changes in the electronic properties of the filled SWCNTs. A p-doping with a Fermi level shift of -0.15 eV was revealed. The obtained information is needed for applications of filled SWCNTs in nanoelectronics, catalysis, biomedicine, sensors, magnetic recording, spintronics, and light emission.

REFERENCES

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